

## 1.1 Time and Distance

- Time comes in mixed units.
- Seconds are very short.
- Hours and minutes are more convenient for everyday time measurement.

Time Unit	How Many Seconds	How Many Days
1 second	1	0.0001157
1 minute	60	0.00694
1 hour	3,600	0.0417
1 day	86,400	1
1 year	31,557,600	365.25
1 century	3,155,760,000	36,525

## 1.1 Time and Distance

- Electronic timers have displays that show mixed units.
- To read a timer you need to recognize and separate out the different units.
- Colons (:) separate the units.



Which is better a stopwatch or a photogate?

- A Stopwatch
- B Photogate

What is the resolution of the timers?

Timer Best Times:

Who has the fastest fingers in the class?

Name

Time

Our class prediction

- Units were invented so people could communicate amounts to each other.

Five or six city blocks



1 kilometer

Height of a first grader



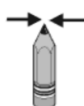
1 meter

Width of your little finger



1 centimeter

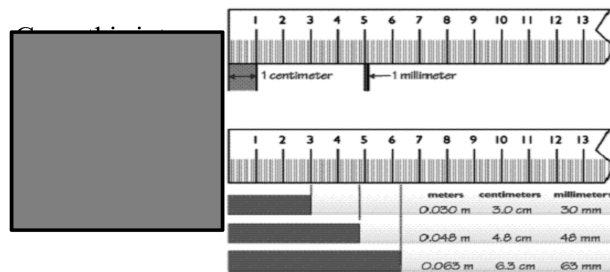
Width of a pencil lead



1 millimeter

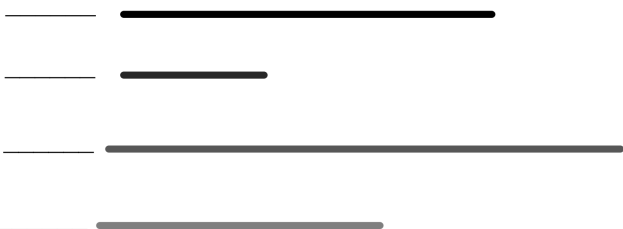
## 1.1 Measurement and Metric System

Reading the metric ruler (meter stick)



Use the ruler to measure these lines

What is the resolution of the ruler? \_\_\_\_\_



Ruler

## Photogate Observations

A	B	What does it measure?
ON	OFF	
OFF	ON	
OFF	OFF	
ON	ON	

## How to read a ruler

1) Determine the units of the ruler

A

B



Ruler A has the units in centimeters

Ruler B has the units in millimeters

However they both measure the same

$1 \text{ cm} = 10 \text{ mm}$

**We will record our vocab in the BACK of our notebooks. Start on THE LAST PAGE**

Copy in your notebooks and define the following vocabulary words. You may need to use your textbook and a dictionary.

● Units

● Resolution

Word	Definition	Example or Illustration
Unit	Numbers in a measurement. Tells you how big or small something is.	cm, meters, grams, seconds
Resolution	The precision of a measurement	0.12 seconds is a LOWER resolution than 0.1233 seconds

## 1.2 Investigations and Experiments

Key Question:

**How do we ask questions and get answers from nature?**



## 1.2 Investigations and Experiments

- An experiment is any situation we set up to observe what happens.
- In science, we usually plan our experiments to give us measurements, which are observations we can record and think about.
- Experiments have questions associated with them.
- Experiments are the way we ask questions of nature.

## Scientific Method

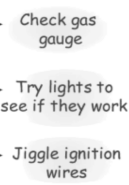
Why doesn't the car start?



### Hypothesis



### Experiment



### Steps in the scientific method

STEP	EXAMPLE
1. Ask a question.	1. Why doesn't the car start?
2. Formulate a hypothesis.	2. Maybe the battery is dead.
3. Design and conduct an experiment.	3. Turn the lights on to test the battery.
4. Collect and analyze data.	4. The lights go on.
5. Make a tentative conclusion.	5. Battery is OK.
6. Test conclusion, or if necessary, refine the question, and go through each step again.	6. Are the ignition wires loose or wet?

How does the height of the ramp affect the time it takes for the car to go from gate A to gate B?

Using your clickers type in the number of the ramp you think will have the fastest time:

Each group will test and record the ramp time from Gate A to Gate B

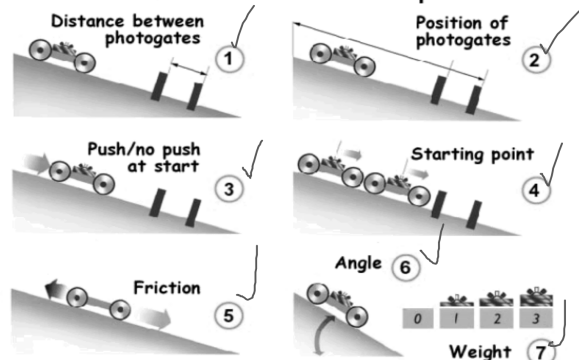
Hole	Group	Time from gate A to gate B
3	JS	1.8093
5 3 <sup>rd</sup>	KH	.34856
7 2 <sup>nd</sup>	KB	.1298
9	KR	.5959
11 1 <sup>st</sup>	AB	.4613

Variables are the things that affect experiments and cause changes in the experiment results. What are variables that affect the time we measured?

1. Car weight
2. photogates distance
3. angle of Ramps
4. distance to photogates
5. Location of gates
- 6.
- 7.
- 8.

## Variables

### Seven variables that affect speed



Try to perfect a drop technique that gives no push at the top. **THIS IS TRICKY.** You know you have it when you can get 3 measurements within 0.0005 sec of each other. If you have tips to share write them on the board.

What factors could affect the time it takes a car to go from point A to point B on the ramp?

✂ Equipment: Photogates, ramp, car

Variables	How could these be changed to influence the time?		
Photogates	position	distance between	
Ramp	Angle of ramp	friction	
Car	Where car starts on ramp	weight	push or no push

## Variables to control

Variable	How we are controlling
Car	No weights, No push Start at top
Photogates	30cm + 50cm
Ramp	We will be <u>changing</u> the ramp angle

Hole	Group	Time from gate A to gate B
3		.3593
5		0.2020
7		.1591
9		0.1401
11		.1206

Revisit the question: How does the height of the ramp affect the time it takes for the car to go from gate A to gate B?

### How to remember variables

Manipulated variables are also called Independent. They are usually graphed on the X-axis → if you are dead ☹️

Dependent variables are also called Responding and are usually graphed on the Y-axis ↑ Y looks like a person pointing up

An automobile manufacturer wants to know how bright brake lights should be in order to minimize the time required for the driver of a following car to realize that the car in front is stopping and to hit the brakes.

What is the independent variable?

What is the dependent variable?

What would be some controlled variables for this experiment?

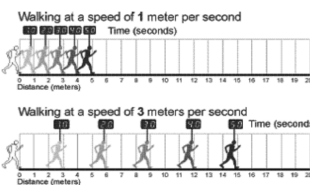
## Chapter 1.2 Science and Measurement

Copy and define the following vocabulary words. You may need to use your textbook and a dictionary.

- Variable (three types to know)
  - Independent or Manipulated
  - Dependent or Responding
  - Controlled

## 1.3 Speed

What is speed and how is it measured?



miles per hour  
meters per second

## 1.3 Speed

- The speed of an object is a measure of **how quickly the object gets from one place to another.**
- To determine a speed, you need to know two things:
  - the distance traveled.
  - the time taken.

Distance	Time	Speed	Abbreviation
meters	seconds	meters per second	m/sec
kilometers	hours	kilometers per hour	km/h
centimeters	seconds	centimeters per second	cm/sec
miles	hours	miles per hour	mph
inches	seconds	inches per second	in/sec, ips
feet	minutes	feet per minute	ft/min, fpm

Velocity —  $v = \frac{d}{t}$

Distance

Time

Equation	Gives you...	If you know...
$v = d/t$	speed	time and distance
$d = vt$	distance	speed and time
$t = d/v$	time	distance and speed

Distance from A to B	Time from A to B in sec	Speed
31.6 cm	.2410 sec	131.1 cm/sec
12.0 in	.2410 sec	49.8 in/sec
1.0 ft	.2410 sec	4.1 ft/sec

$32 \div 0.1810 = 176.795580111$

group	Time from A to B (12 inches apart)
Kasara & Tiff	.2388
Samantha, Kory yesinia	.2331
Erica, Ryan	.2408
Erica & Alex	<del>.2398</del> .2512
Jo & Ms	.2362
	.2496

## Setting up an experiment

**Hypothesis : MV does - to RV**

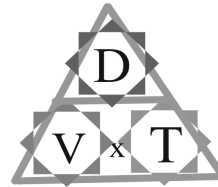
**Variable tested : MV**

### Procedure :

- 1) Name controlled variables .
- 2) Name the MV & say how it will be changed
- 3) Name RV & Say how you will record it



Speed formula triangle. To use click on the thing you want to calculate. The triangle will show you what formula you will need to use.



$$v = \frac{d}{t}$$

Distance

Speed

Time

### Speed Formula triangle



To use cover the thing (D, V or T) you want to find . Whatever is left uncovered shows you the formula

When working a word problem list the given and the unknowns #7

V=

D=

T=

Formula=

**Text in the answers**

**Don't forget the units!**

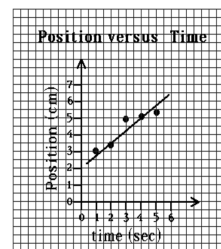


## Making and using graphs

A graph is a chart or drawing that displays the relationship between numbers or amounts.

- *Bar graphs* for results that are categories (color, name, type, qualitative)
- *Line graphs* for data that are measured (time, mass, length, quantitative).

Graphs are a useful tool in science. One of the most valuable uses for graphs is to "predict" data that is not measured on the graph. The slope of the line graph can predict results or find a mathematical relationship between the MV and RV



time (s)	position (cm)
1	3.0
2	3.4
3	4.8
4	5.0
5	5.3

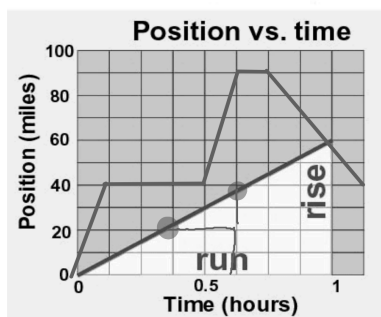
In science you don't always connect the dots. Scientists use a "best-fit" line that shows the trend in the data

**Extrapolate:** extending the graph, along the same slope, above or below measured data.

**Interpolate:** predicting data between two measured points on the graph.

## Speed

Speed is the slope of the position vs. time graph.



0.3hr 0.7hr  
0.4hr

$$\text{Slope} = \frac{\text{rise}}{\text{run}}$$

$$= \frac{60 \text{ miles}}{1 \text{ hour}}$$

$$= 60 \text{ mph}$$

cpo science

## 1.3 Speed

Copy and define the following vocabulary words. You may need to use your textbook and a dictionary.

- Distance
- Speed
- Velocity
- Time

Question...?

When working a word problem list the given and the unknowns

$V = ?$   
 $D = 12.0\text{m}$   
 $T = 4.0\text{sec}$

$\frac{12.0\text{m}}{4.0\text{sec}} = 2.8\text{ m/sec}$

2.8 m/s

Text in the answers  
Don't forget the u

Question...?

When working a word problem list the given and the unknowns #2

$V = ?$   
 $D = 60.0\text{ km}$   
 $T = 3.5\text{ hr}$

Formula =  $V = \frac{D}{T}$

Text in the answers  
Don't forget the un